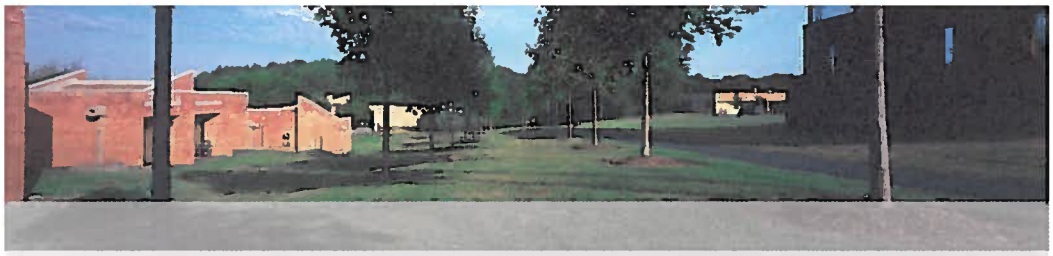




HAZELDEN

Research Update is published by the Butler Center for Research to share significant scientific findings from the field of addiction treatment research.

RESEARCHUPDATE

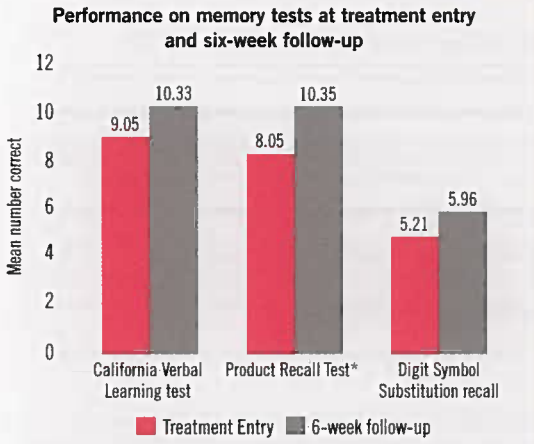
BUTLER CENTER FOR RESEARCH NOVEMBER 2006

# Cognitive Improvement and Alcoholism Recovery

Most alcoholics are aware that alcohol use causes at least immediate short-term memory problems. While drinking they may easily forget new information, such as people's names or directions. After a drinking episode, they may be frustrated by their occasional inability to remember an entire conversation or event, a phenomenon known as a blackout. But what happens in recovery? How resilient is the brain?

### How Does Alcohol Affect the Brain?

Over half of people entering treatment for alcohol or other drug dependence have some brain impairment.[15] The impairment might reveal itself in the following areas[9,11,16,18,21] *Working memory:* holding numbers or facts in one's head for use in the immediate future, e.g. for balancing a checkbook or considering several options. While new information may be learned, it may take more review and repetition than it normally would. *Executive control functions:* these are higher level cognitive functions that are called upon in new or unexpected situations that involve attention, planning, abstract reasoning, problem solving, judgment and sensitivity to the consequences of one's behavior. *Visuospatial perception:* ability to grasp new and complex information visually; recognition and recall of visual images; the skills to learn new routes through buildings or to work a puzzle.




*p < .05 Note: The memory tests are not based on the same number of possible responses. Source: Bates et al., 2005.

There are recent advances in understanding what has happened in the brain to cause these deficits. (1) *Structural changes:* Magnetic Resonance Imagery (MRI) studies consistently show shrinkage of the brain among alcoholics. Both the grey matter (nerve cells) and the white matter (transmission routes) lose volume, especially in the prefrontal region.[7,21] Loss of brain matter correlates with age and quantity of alcohol consumed.[19] (2) *Neurotoxicity:* Alcohol causes new nerve cells to die. Throughout life (though more slowly as we age) new brain cells are created, a process known as neurogenesis;[10] alcohol interferes with neurogenesis. (3) *Circuitry:* Recent research[21] suggests that it may be the degradation of the brain's circuitry, or nerve transmission, that is responsible for cognitive deficits. This may result in what is called "processing inefficiency." As the brain reorganizes how it processes information, it compensates for deficits and uses higher level functions for lower level tasks. This means the brain needs to work harder to perform the

> CONTINUED ON BACK

### THE HAZELDEN EXPERIENCE

All patients are screened for cognitive deficits upon entry to treatment at Hazelden, and when necessary, referred for further testing. Individual treatment plans accommodate deficits so patients can benefit maximally from their treatment experience.

At the Butler Center for Research, a study is underway to examine cognitive changes over time among middle aged and older adults with alcohol dependence. We hope to use this information to assist clinicians in better serving the needs of those with cognitive deficits.

### CONTROVERSIES & QUESTIONS

*How does alcohol compare with other drugs in terms of recovery of cognitive impairment?*

In most cases there is no overall difference in cognitive improvement based on type of drug used.[4] Most substances of abuse cause similar types of impairments and the brain recovers in similar ways.

*Are some people too impaired to recover their full cognitive functioning?*

Almost all people can recover cognitive functioning. Improvement depends on abstinence and time, not on severity of initial impairment. There is a small subset of individuals who may have a specific type of neurological disorder associated with long term alcohol use and thiamine deficiency (Wernicke-Korsakoff's syndromes) which is not reversible.[1]

### HOW TO USE THIS INFORMATION

**Clinicians:** Assess patients' level of cognitive functioning and target interventions accordingly. Heavy emphases on educational methods early in treatment may not be effective, even if a patient has a high level of education or intellectual ability. Use novel ways to repeat material.

**Newly Recovering People:** If you feel you are having difficulty remembering, learning, or understanding, ask for help. This is a normal part of early recovery and nothing to be ashamed of. Staying abstinent and giving yourself time in recovery are the best healers.

< CONTINUED FROM FRONT



same functions.[8,21] Some people may be more susceptible to alcohol's effects. Women typically experience the negative physical consequences of alcoholism sooner than men, given the same number of years of drinking. This phenomenon, known as "telescoping," has long been known to account for relatively early onset liver and heart damage among women alcoholics, but recent research suggests it is true for the brain as well.[13,12] Adolescents may be especially vulnerable to the neurotoxic effects of alcohol, perhaps because the brain is still developing and neurogenesis is active.[2,14]

## What Happens in Recovery?

For most people, the brain heals. The healing is dependent on abstinence and time. MRIs show increases in brain volume during abstinence as gray and white matter increase. Neuropsychological test results reflect concomitant improvements in functioning.[17] Neurogenesis resumes unimpeded, associated with increases in positive mood and ability to learn. In turn, recovery tasks become easier and the resulting maintenance of abstinence makes continued cognitive improvement possible, creating a spiral of continued progress.[6]

How quickly do these changes occur? Some improvements occur within the first month of recovery and shortly thereafter, particularly in short term memory and visuospatial tasks.[22] For example, in one study,[4] researchers tested 118 male and 79 female substance abusers at treatment entry and six weeks later. They found the biggest improvement in short term memory and smaller though significant gains in speed of reaction time, executive processing and verbal factors. There were many individual differences. Relapse to alcohol or drugs and/or a diagnosis of antisocial personality predicted less improvement, particularly in executive control functions. Age alone was not a factor, leading the researchers to state that, "individuals with substance use disorders of all ages are capable of some degree of short-term cognitive recovery."[4]

While some gains come early in recovery, some of the more subtle cognitive improvements in executive control functioning may take several years. As one group of researchers point out after reviewing longitudinal results, "...the message emerging from these studies is clear: Abstinence contributes to recovery, and longer abstinence contributes to greater recovery..."[17]

Do people with brain impairment have less chance for recovery? No. In fact, one MRI study found that those with the greatest impairment showed, with abstinence, the greatest improvement.[22] This reflects not only the obvious greater room for improvement but also the resiliency of the brain. And, extent of cognitive impairment does not predict treatment success. In light of this finding, Morgenstern and Bates[15] speculate that motivation may be a critical component, and that the relatively simple strategies of using support systems and avoiding alcohol-related situations may be the most important tools in early recovery. The Twelve Step approach may be advantageous because of the repetition and social network it provides and because it reinforces breaking complex tasks into smaller ones.[3]

## Summary

Alcohol and drug use can result in cognitive deficits. But these deficits should not keep the substance dependent person from seeking help through treatment. Studies have demonstrated improvement in cognitive skills and functioning can occur through treatment and abstinence.

hazelden.org

**BUTLER CENTER FOR RESEARCH** NOVEMBER 2006

The Butler Center for Research informs and improves recovery services and produces research that benefits the field of addiction treatment. We are dedicated to conducting clinical research, collaborating with external researchers, and communicating scientific findings.

**Candice Walker, Ph.D.**, Issue Author
**Valerie Slaymaker, Ph.D.**, Director

If you have questions, or would like to request copies of Research Update, please call 800-257-7800 ext. 4405, email butlerresearch@hazelden.org, or write BC 4, P.O. Box 11, Center City, MN 55012-0011.

© 2006 Hazelden Foundation
Hazelden and the Hazelden logo are registered trademarks of the Hazelden Foundation.

655900 (10/06)
BCR-RU28

### References

1. A.D.A.M. Medical Encyclopedia [Internet]. Atlanta (GA): A.D.A.M., Inc.; ©2005. Wernicke-Korsakoff syndrome; [updated 2005 Jul 20; cited 2006 Aug 27]. Available from: http://www.nlm.nih.gov/medlineplus/ency/article/000771.htm.
2. Barron, S., White, A., Swartzwelder, H.S., Bell, R.L., Rodd, A.Z., Slawecki, C.J., Ehlrs, C.L., Levin, E.D., Rezvani, A.H., & Spear, L.P. (2005). Adolescent vulnerabilities to chronic alcohol or nicotine exposure: Findings from rodent models. *Alcoholism: Clinical and Experimental Research, 29*, 1720-1725.
3. Bates, M.E., Barry, D., Labouvie, E.W., Fals-Stewart, W., Voelbel, G., & Buckman, J.F. (2004). Risk factors and neuropsychological recovery in clients with alcohol use disorders who were exposed to different treatments. *Journal of Consulting and Clinical Psychology, 72*, 1073-1080.
4. Bates, M.E., Voelbel, G.T., Buckman, J.F., Labouvie, E.R., & Barry, D. (2005). Short-term neuropsychological recovery in clients with substance use disorders. *Alcoholism: Clinical and Experimental Research, 29*, 367-377
5. Brokate, B., Hildebrandt, H., Eling, P., Fichtner, H., Runge, K., & Timm, C. (2003). Frontal lobe dysfunctions in Korsakoff's syndrome and chronic alcoholism: Continuity or discontinuity? *Neuropsychology, 17*, 420-428.
6. Crews, R.T., Buckley, T., Dodd, P.R., Ende, G., Foley, N., Harper, D., He, J., Innes, D., Loh, E.W., Pfefferbaum, A., Zou, J., & Sullivan, E.V. (2005). Alcoholic neurobiology: Changes in dependence and recovery, *Clinical and Experimental Research, 29*, 1504-1513.
7. Ende, G., Welzel, H., Walter, S., Weber-Fahr, W., Diehl, A., Hermann, D., Heinz, A., & Mann, K. (2005). Monitoring the effects of chronic alcohol consumption and abstinence on brain metabolism: A longitudinal proton magnetic resonance spectroscopy study. *Biological Psychiatry, 58*, 974-980.
8. Fama, R., Pfefferbaum, A., & Sullivan, E.V. (2004). Perceptual learning in detoxified alcoholic men: Contribution from explicit memory, executive function, and age. *Alcoholism: Clinical and Experimental Research, 28*, 1657-1665.
9. Fishbein, D., Hyde, C., Eldreth, D., London, E.D., Matochik, J., Ernst, M., Isenberg, N., Steckley, S., Schech, B., & Kimes, A. (2005). Cognitive performance and autonomic reactivity in abstinent drug abusers and nonusers. *Experimental and Clinical Psychopharmacology, 13*, 25-40.
10. Herrera, D.G., Yague, A.G., Johnsen-Soriano, S., Bosch-Morell, F., Collado-Morente, L., Muriach, M., Romero, F.J., & Garcia-Verdugo, J.M. (2003). Selective impairment of hippocampal neurogenesis by chronic alcoholism: Protective effects of an antioxidant. *Proceedings of the National Academy of Sciences, 100*, 7919-7924.
11. Hildebrandt, H., Brokate, B., Eling, P., & Lanz, M. (2004). Response shifting and inhibition, but not working memory, are impaired after long-term heavy alcohol consumption. *Neuropsychology, 18*, 203-211.
12. Mann, K., Ackermann, K., Croissant, B., Mundle, H., Nakovics, H., & Diehl, A. (2005). Neuroimaging of gender differences in alcohol dependence: Are women more vulnerable? Alcoholism: *Clinical and Experimental Research, 29*, 896-901.
13. Mann, K., Batra, A., Gunthner, A., & Schroth, G. (1992). Do women develop alcoholic brain damage more readily than men? *Alcoholism: Clinical and Experimental Research, 16*, 1052-1056.
14. Monti, P., Miranda, R. Jr., Nixon, K., Sher, K.J., Swartzwelder, H.S., Tapert, S.F., White, A., & Crews, F.T. (2005). Adolescence: Booze, brains, and behavior. *Alcoholism: Clinical and Experimental Research, 29*, 207-220.
15. Morgenstern, J., & Bates, M.E. (1999). Effects of executive function impairment on change process and substance use outcomes in 12-step treatment. *Journal of Studies on Alcohol, 60*, 846-855.
16. Nixon, S.J., Tivis, R.D., Jenkins, M.F., & Parsons, O.A. (1998). Effects of cues on memory in alcoholics and controls. *Alcoholism: Clinical and Experimental Research, 22*, 1065-1069.
17. Rosenbloom, M.J., Pfefferbaum, A., & Sullivan, E.V. (2004). Recovery of short-term memory and psychomotor speed but not postural stability with long-term sobriety in alcoholic women. *Neuropsychology, 18*, 589-597.
18. Rosenbloom, M., Sullivan, E.V., & Pfefferbaum, A. (2003). Using magnetic imaging and diffusion tensor imaging to assess brain damage in alcoholics. *Alcohol Research & Health, 27*, 146-152.
19. Spaminato, M., Vittoria, M.D., Castillo, M., Rojas, R., Palacios, E., Frascheri, L., & Descartes, F. (2005). Magnetic resonance imaging findings in substance abuse: Alcohol and alcoholism and syndromes associated with alcohol abuse. *Topics in Magnetic Resonance Imaging, 16*, 223-230.
20. Sullivan, E.V., Fama, R., Rosenbloom, M.J., & Pfefferbaum, A. (2002). A profile of neuropsychological deficits in alcoholic women. *Neuropsychology, 16*, 75-83.
21. Sullivan, E.V., & Pfefferbaum, A. (2005). Neurocircuitry in alcoholism: A substrate of disruption and repair. *Psychopharmacology, 180*, 583-594.
22. Sullivan, E.V., Rosenbloom, M.J., Pfefferbaum, A., & Lim, K.O. (2000). Longitudinal changes in cognition, gait, and balance in abstinent and relapsed alcoholic men: Relationships to changes in brain structure. *Neuropsychology, 14*, 178-188.